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Perspective**

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Abstract

Almost everyone agrees on two general features displayed by the recent banking crisis, namely: the crisis was stupefyingly complex and the financial system was devoured by its own creations. Beyond these points of agreement, there are many questions that will be debated by academics and policymakers for decades. One of the outstanding questions is what caused the financial crisis 2007-08. To shed light on this question, the paper compiles a list of the tentative causes of the recent financial crisis, discusses their separability and attempts an appraisal of the separable causes using the Hicksian methodology for causality analysis. Specifically, this paper identifies three major separable causes of the recent banking crisis and brings into sharp focus the far-from-trivial requirements that are necessary in order to demonstrate that a particular set of events can indeed be the preponderant causes of the severe banking crisis 2007-08.

JEL: B.41, G10

Key words: Financial crisis 2007-08, causality analysis, Hicksian methodology, separable causes

1. Introduction

In the wake of the recent financial meltdown, the subject of financial crises has come to the forefront of academic and policy analysis. As Reinhart and Rogoff (2008a), (2008b) have documented, financial crises are often linked to economic growth, capital inflows and financial innovation. The general category of financial crises includes a variety of phenomena such as banking crisis, inflation outbursts, currency crashes, external defaults, and domestic defaults. Although the crisis 2007-2008 is usually referred to as the ‘financial crisis 2007-08,’ it is clear that the expression ‘banking crisis 2007-08’ is a better term.¹

All banking crises have an onset, an outbreak and a culmination. They can be either severe or mild. A *severe* banking crisis occurs when the lending process suddenly stops. For example, the financial meltdown 2007-08 started in July 2007 with the bailout of Bear Stearns, exploded out of control on 15 September 2008 with the fall of Lehman Brothers, and culminated as a severe banking crisis in October 2008. Severe financial crises occur when gradually rising complexity brings about pervasive Knightian uncertainty.²

The financial turmoil 1997-98 –originated by the collapse of the Malaysian ringgit in 1997 and the Russian devaluation of the ruble and declaration of a moratorium on 17 August 1998– illustrates a mild financial crisis. The financial instability ended with the near-bankruptcy of the hedge fund Long Term Capital Management (LTCM) and its rescue by a creditor consortium organized by the Federal Reserve in September 1998. The LTCM episode put fear in the heart of the financial community but it was not a severe banking crisis. In fact, the rescue package avoided the seizing up of markets.

Almost everyone agrees on two general features displayed by the recent banking crisis, namely: the crisis was stupefyingly complex and the financial system was devoured by its own creations. Beyond these points of agreement, there are many questions that will be debated by academics and policymakers for decades. One of the outstanding questions is what caused the financial crisis 2007-08.

Causality is not a hot topic in economics. Apparently, the reason is that most economists see the notion of causality as neither necessary nor interesting. A case in point can be found in Samuelson’s *Foundations*:

The only sense in which the use of the term causation is admissible is in respect to changes in external data or parameters. As a figure of speech, it may be said the changes in these *cause* changes in the variables of our system. An increase in demand, i.e., a shift in the demand function due to a change in the data, tastes, may be said to cause an increased output to be sold. Even here, when several parameters change simultaneously, it is impossible

¹ In this paper the two terms ‘financial crisis 2007-08’ and ‘banking crisis 2007-08’ are used interchangeably because there is no room for confusion.

² For a recent model of financial crises incorporating Knightian uncertainty, see Caballero and Simsek (2009).

to speak of causation attributable to each except in respect to limiting rates of change (partial derivatives).
Samuelson (1965, pp. 9-10) [*Italics in original*]³

Another (more recent) example is the view of James J. Heckman:⁴

I argue that causality per se is not an interesting concept.
What is interesting is the question of whether an empirically determined relationship can be used to provide valid forecasts of policy on an outcome.
Heckman (2003, p. 73)

Notwithstanding, economic analysis involving causality is not unusual. Sometimes economists speak about ‘informed conjectures’ to suggest that there are some ‘proximate causes’ explaining a given empirical event E, say the financial crisis 2007-08. See, for example, Diamond and Rajan (2009). At other times, economists allude to –but typically do not specify– the causes of the event they are explaining. For example, Brunnermeir (2009) concludes his illuminating paper about the liquidity and credit crunch 2007-08 asserting “This paper outlined several amplification mechanisms that help explain the causes of the financial turmoil.” However, the *explicit* identification of the causes of the banking crisis 2007-08 cannot be found in Brunnermeir (2009).

Generally speaking, the tacit message conveyed by research on the causes of major economic events such as banking crises can be summarized as follows: at this initial stage, we are only developing models that help isolate the potential causes of the event E; further research will enable us to find the ultimate causes of E. The promise is always in the future.

In essence, there are two different approaches to causality in economics. Speaking loosely, one can describe two groups of economists: those who believe that the economics profession should learn about causality through induction, and those who do not deny the importance of observation but believe that theoretical economics itself gives special insight into causality. In the first group we find the numerous followers of Clive W. J. Granger (1969). Granger causality is data-based without direct reference to economic theory developed to apply to dynamic time series models. The second group does not appear to contain many members and consists of those economists who follow John Hicks’ 1979 *Causality in Economics*.⁵ According to Hicks, any statement of causality has direct reference to a theory or model.

There are two kinds of causality: strong causation (C is the sole cause of E) and weak causation (C is one of the causes of E). When there is more than one cause for E to have happened, interesting possibilities emerge. In fact, weak causation can be of two types: separable, meaning that C is a cause of E by itself, and non-separable, in which C is part of a separable cause but C is not a cause in isolation. Non-separability

³ Paul Anthony Samuelson won the Nobel Prize in economics in 1970.

⁴ Heckman shared the 2000 economics Nobel Prize with Daniel L. McFadden.

⁵ For a compact discussion of causality in economics and econometrics, see Hoover (2008). Surprisingly, Hoover (2008) does not cite Hicks’ *Causality in Economics*. This raises a puzzling question.

includes the possibility of a causal relation between causes. Moreover, the relation between causes can go one way or both ways. The latter possibility is termed ‘mutual causality’ by Hicks (1979, p. 19).

To shed light on the question why the financial crisis 2007-08 happened, this paper compiles a list of the tentative causes of the recent financial crisis, discusses their separability and attempts an appraisal of the separable causes using the Hicksian methodology for causality analysis. Specifically, this paper identifies three major separable causes of the recent banking crisis and brings into sharp focus the far-from-trivial requirements that are necessary in order to demonstrate that a particular set of events can indeed be the preponderant causes of the severe banking crisis 2007-08.

One obvious question immediately suggests itself. Why is important to search for the causes of the financial crisis? The real chance of a meaningful global financial reform lies in the understanding of the causes of the recent financial meltdown. However, the issue of financial regulation is beyond the scope of the present paper.⁶

The organization of the paper is as follows. Sections 2 and 3 provide a very brief qualitative description of the critical factors underlying the financial meltdown. Section 4 compiles a list of tentative causes and discusses the arguments for particular separable causes. Section 5 establishes the conditions under which the identified potential causes can indeed be considered as the actual causes of the financial crisis 2007-08. Section 6 offers a summary with a few concluding remarks.

2. The Anatomy of the Financial Crisis 2007-08: Key Factors

Speaking very loosely, a financial crisis is the observable effect E of the excesses which lead to a boom and an inevitable bust. Theoretical causality analysis starts with the search for tentative causes of E. To this end, it is necessary to sketch the economic logic for rationalizing the effect E. In the recent crisis, an excess of world saving combined with lax monetary policy and a number of financial innovations led to a housing and credit bubble, and eventually, to a catastrophic financial collapse. This compact description is a rough first approximation to an extraordinary complex set of phenomena suggesting that the financial crisis may not be attributable to a single cause.

Quite obviously, it is necessary to implement a second approximation consisting of a characterization of the key factors (global saving glut, loose monetary policy and financial innovations) conducive to the double bubble. There are also additional factors inextricably linked to the financial crisis –such as excessive risk-taking and the existence of a ‘shadow’ banking system that developed without enough supervision– requiring at least a third approximation.

2.1 Monetary Excesses and Financial Innovation

Ben Bernanke warned in his influential ‘saving glut’ speech: “...the risk of a disorderly adjustment in financial markets always exists, and the appropriately conservative approach for policymakers is to be on guard for any such

⁶ For a concrete proposal of financial regulation focusing on innovation, see Pol (2009).

developments.” Bernanke (2005, p. 9). Excess world saving was due to asymmetries in financial development and growth prospects across different countries. In particular, the rapid growth of China and other East Asian economies led to large capital flows to the US and a decline in the US real interest rates. Caballero et al. (2008).

Empirical evidence showing that interest rates were unusually low during 2001-2008 can be found in Taylor (2008, p. 3). This author shows that there were monetary excesses during this period.⁷ In an environment of low real interest rates, US households were induced to take excessive housing risk, and thereby, the US residential housing market –together with the related markets for structured credit instruments– became the epicentre of the boom.

There are four financial innovations that combined with each other to play a central role in the financial crisis 2007-08. First, the sub-prime mortgage innovation was designed to allow new buyers with lower credit scores and little documentation of income to purchase homes. Moreover, sub-prime mortgages were used not only for home purchase but also for cash-out refinancing.⁸

The second financial innovation, namely securitization, is the defining characteristic of modern banking. Banks pool assets (from mortgages to student loans) and sell the packages of assets to other investors. The model of endogenous financial instability developed by Shleifer and Vishny (2009) combines three strands (micro-foundations of credit cyclicity, asset liquidity and behavioural corporate finance) by focussing on the mechanism of transmission of investor sentiment into commercial banking and the real economy. One of the theorems derived from their model is that “The principal source of instability is securitization.” Shleifer and Vishny (2009, p. 33).

Third, the chief financial innovation used to provide AAA-rated bonds was re-securitization which originated the *Collateralized Debt Obligations (CDOs)*. These complex financial products were the prototypal structured finance securities. The creation of a CDO involves two financial engineering operations: (a) ‘repackaging,’ consisting of putting together collections of securitized assets to originate a *Special Purpose Vehicle (SPV)*; and (b) ‘tranching,’ consisting of the extraction of sub-collections of assets from an SPV, ordering them by degree of risk and specifying how the different tranches will absorb losses and pay interest. The process of repackaging and tranching originated some securities that were –only in appearance– safer than the average asset in the collateral pool and some that were riskier. In other words, the process concentrated default risk on one part of the capital structure and created securities that were considered almost riskless.

Finally, there was a financial innovation that attracted particular attention from informed observers: the *Credit Default Swap (CDS)*. The CDS innovation –due to

⁷ ‘Monetary excesses’ are defined as the difference between two interest rates, say r_a and r_c , where r_a denotes the actual interest rate and r_c is the interest rate that would have been if the Federal Reserve had followed the kind of policy that worked well during the great moderation era that began in the early 1980s.

⁸ ‘Cash-out refinancing’ means that the homeowner converts a fraction of the equity in the home into cash by cancelling the existing loan and taking out a new and larger loan.

Blythe Masters of J.P. Morgan— was introduced in 1995.⁹ The market for CDS was meant to insure against systemic risk, but instead brought the system to its knees. In fact, the eruption of the sub-prime crisis in July 2007 caused the value of the CDOs to plunge and this, in turn, caused buyers of CDSs on such securities to demand the corresponding payment. This (largely unregulated) market was blamed for the spread of speculative behaviour in widening circles. George Soros (2009) argued that speculative pressure within the CDS market makes the swaps to become delinked from their function of hedging against risk.

2.2 Double Bubble

Public policy decisions influenced the creation of new financial products. For example, the US government's support for the development of secondary mortgage markets through government sponsored firms (Fannie Mae and Freddie Mac) encouraged the development of new products such as the sub-prime mortgage innovation. The expansion of the sub-prime mortgage market led to a deterioration in lending standards –as measured by a reduction in loan denial rates and a sizable increase in loan-to-income ratios. Furthermore, the rapid expansion of the refinancing business made it much easier for home owners to refinance their mortgages to take advantage of low interest rates and increasing home prices. Dell'Ariccia et al. (2008).

The housing bubble was accompanied by a massive credit expansion. Mortgages and other loans were to a very significant extent securitized and re-securitized tranching them into securities and selling them off. Financial institutions were able to make quick profits from changes in investor sentiment. Money market funds demand for AAA-rated bonds for reasons beyond the basic economics of payoffs was fuelled by monetary excesses.

As the housing bubble collapsed, mortgages began to default. A significant amplification of the perceived uncertainty occurred when investors trashed the credit agencies rosy ratings. With benefit of hindsight, the substantial increase in the banks' CDS spread in the period between the bailout of Bear Stearns and the fall of Lehman Brothers was a clear indicator of pervasive Knightian uncertainty.

It should hardly be necessary to mention that the intricacies of the banking crisis 2007-08 do not end here. There were a number of additional factors conducive to the sudden stop of the lending process at the end of 2008. These include: refinancing racket effect, ignorance, rating agencies, investment banks, snatcher culture, shadow banking system and poor supervision.

3. Additional Factors

⁹ The CDSs are insurance contracts whose main function is to hedge against default. The buyer of the CDS makes payments to the seller in order to receive protection. The buyer receives a payment if a credit instrument (for example, a bond or a loan) goes into default or in the case of a specified credit event such as bankruptcy. These financial instruments are the derivatives that Warren Buffet termed 'financial weapons of mass destruction' in his famous 2002 warning.

Over the past two decades, mortgage debt has grown more rapidly than home values due to the expansion of refinancing activities such as ‘cash-out refinancing’ where the homeowner receives cash after refinancing. Greenspan and Kennedy (2009). If the growth of these activities makes it easier for homeowners to refinance their mortgages to take advantage of low interest rates and increasing housing prices, the agglomeration of leverage during a market rise implies higher correlation defaults during a market drop. Thus, an expansion of the refinancing activity may engender systemic risk through the *refinancing racket effect*.¹⁰

Anecdotal evidence points to the fact that the financial nomenclature became increasingly un-understandable not only for investors in general but also for some key top financial executives. For instance, acronyms such as SPVs, CDOs, CDSs, MBSs, and Alt-A, are difficult to understand or decipher at first glance.¹¹ More importantly, investor understanding lagged behind the growing complexity of financial products such as CDOs. Under this optic the financial crisis could be traced to the existence of ‘ignorance’ in the sense of difficulty of understanding the riskiness of complex financial products.

Some observers blamed the rating agencies for being, in part, responsible for the financial crisis. Many CDOs were engineered to obtain high ratings with the ‘help’ of these agencies. Indeed, a substantial proportion of the structured finance securities was highly rated by rating agencies. For example, more than 50% of the CDOs rated by Moody’s carried a AAA rating –the highest possible rating. Benmelech and Dlugosz (2009, p. 1).

Sophisticated institutional investors placed too much faith in the ratings agencies. This is understandable at least for two reasons. First, investors were unable to compute the risk underlying the CDOs. Second, they knew that numerous regulations used ratings as a criterion for permissible investments or as a component in required capital levels. Regrettably, the ratings models used by these agencies failed to properly account for default correlation across households or firms. Benmelech and Dlugosz (2009, p.6).

¹⁰ This effect was introduced and quantified by Khandani et al (2009, p. 2): “Once property values decline, a wave of defaults becomes unavoidable because mortgage lenders have no mechanism such as a margin call to compel homeowners to add more equity to maintain their leverage ratio, nor can homeowners reduce their leverage in incremental steps by selling a portion of their homes and using the proceeds to reduce their debt. This self-synchronizing “racket effect” of the refinancing market can create significant systemic risk in an otherwise geographically and temporarily diverse pool of mortgages, steadily increasing the aggregate leverage of the housing market until it reaches a systemically critical threshold.”

¹¹ This compelling point was forcibly made by Paul Kedrosky:

There is an entire language required to understand this new generation of financial technologies, from credit default swaps to collateralized debt obligations to residential mortgage-backed securities, not to mention the corresponding three - and four-letter abbreviations. There’s also data on current account deficits and yield spreads. Most people, faced with this tsunami of data, do only the rational thing: they give up.
Kedrosky (2008, p. 21)

Investment banks got themselves into so much trouble because they sold CDOs and also hold inventories of these assets on their own books. There are at least two plausible reasons for this dual role of banks. One is that the bankers believed that these securities were worthwhile investment. Coval et al. (2009, p. 22), Diamond and Rajan (2009, p. 4). The second reason –not necessarily inconsistent with the first one– is that the banks had to have a ‘skin in the game’ (holding a fraction of loans to outside investors) to signal the good credit quality of the securities. Shleifer and Vishny (2009, p. 9).

Many years ago, John R. Hicks (1954) introduced the insight that firms may seek a balance between short-run and long-run profit maximization. Specifically, Hicks suggested that we should think of a decision maker as maximizing a convex combination of the rates of short-period profit g and long-period profit G , defined as $ag + bG$, where a and b are weights. He also suggested that the weights a and b may be governed by factors such as the willingness to bear risks and the rate of time preference, and introduced the compelling –but often forgotten– dichotomy *Sticker*/*Snatcher*. Hicks (1954, p. 45). In the context of financial markets, the Hicksian dichotomy can be paraphrased as follows. A financier confining attention to the maximization of long-term value (e.g. a venture capitalist) is called *Sticker* (high b relative to a). A financial executive who is interested in sizing a quick profit (e.g. a hedge fund manager) can be called *Snatcher* (high a relative to b).

The culture of excessive risk-taking observed during the double bubble 2001-08 is consistent with the predominance of (perfect) *Snatcher* behaviour ($a = \text{one}$). In fact, there were at least three mutually reinforcing factors conducive to a high a relative to b : first, incentives to the top management; second, flawed internal compensation and control; and third, the impact of investor sentiment on the bank’s behaviour.

The first two factors were singled out by Diamond and Rajan (2009). Top managers may not seek to maximize long-term bank value because they prefer to increase their stock prices and enhance their personal reputations. Even if top managers are perfect *Stickers* ($b = \text{one}$), it may be difficult to control traders working for the bank. The third factor prompting *Snatcher* behaviour (investor sentiment) has been stressed by Shleifer and Vishny (2009):

investor sentiment, through securitization, infects banking and leads to cyclicity of profits, of investment, and at least of the market value of the balance sheet. Banks used up all their capitals in booms knowing full well that a crisis will come and that they will suffer (at least book) losses. But they realize that there is so much money to be made during booms that they should nonetheless extend themselves fully. Shleifer and Vishny (2009, p. 20)

Furthermore, financial institutions operating outside the regulated banking system built up financial positions by borrowing short-term and lending long-term. The participants in this ‘shadow’ banking system became vulnerable to non-bank runs, that is, they could fail if markets lost confidence and refused to extend or roll over short-term credit as it happened with Bear Stearns. If investors expect that other

investors expect that CDOs issued by ‘shadow’ banks will be deprived of liquidity, ‘equilibrium fragility’ may happen.¹²

One of the distinguishing features of the financial crisis 2007-08 was regulation failure, not lack of regulation. The failure emerged from the inability of financial market regulations and supervisory systems in some developed countries to stop excessive risk taking and faulty management practices. For example, the failure of US Securities and Exchange Commission (SEC) can be easily verified by looking at its home page (What do we Do?)¹³, where one can find the mission of the Office of Risk Assessment (ORA):

The Office of Risk Assessment helps the SEC anticipate, identify, and manage risks, focusing on early identification of new or resurgent form of fraud and illegal or questionable activities. ORA focuses on risk issues across the corporate and financial sector, including issues relevant to corporate disclosure, market operation, sales practices, new product innovation, and other activities of financial markets participants. ORA analyses information from a variety of sources, such as external experts, domestic and foreign agencies, industry and financial services, empirical data and other market data. The Office develops and maintains the overall process for risk assessment throughout the SEC and serves as a resource for divisions and other offices in their risk assessment efforts, working closely with them as they work to identify, prioritize and mitigate risks.

Wall Street’s worst year in decades culminated with another supervision failure: the Madoff affair. Christopher Cox, the SEC’s chairman, recognized that SEC overlooked Mr Madoff financial innovation consisting of a pyramid strategy in which existing investors’ returns were topped up with money from new investors. Both the SEC and the Financial Industry Regulatory Authority faced harsh criticism because these agencies were unable (or unwilling) to identify the largest Ponzi scheme in history. Bernard Madoff –the confessed swindler who developed the fraud– expressed to the SEC Inspector-general David Kotz in an interview early in 2009 that he was surprised that the SEC’s enforcement investigators did not discover the Ponzi scheme after he had told them plainly suspect information.¹⁴

¹² Calvo (2009) develops a model of behaviour discontinuity under the assumption that the shadow system succeeds in ‘printing money’ through CDOs.

¹³ Search done on Google, 11 December, 2008.

¹⁴ See “SEC Blunders Amaze Madoff” by Zachary Goldfarb, *The Washington Post*, 1 November, 2009.

Finally, an additional risk-inviting factor, namely: the ‘too-big-to-fail’ phenomenon, should not be overlooked. The importance of this phenomenon has been carefully examined by Stern and Feldman (2006). The notion of ‘too-big-to-fail’ revolves around the credibility of policymakers’ commitment to *not* bailout large financial institutions. The empirical evidence strongly points to the fact that when, for example, a large bank is about to fail, policymakers will renege on their pledge because they want to avoid the systemic risk that the failure of the bank would entail.¹⁵

4. Sifting and Sorting Potential Causes

From now on, the event E representing the effect in the causal relationship ‘C caused E’ will be identified with the sudden stop of the lending process at the end of October 2008. The preceding sketch of the financial logic underlying the banking crisis 2007-08 enables us to compile the list of tentative causes of E shown in Table 1.

TABLE 1 HERE

Although these elements were not entering the financial system simultaneously, it is clear that they were operating jointly during the same period of time T (somewhat roughly, 2001-2008), and thereby, the elements included in the list can be considered as contemporaneous events. All ten items have merit. None is unassailable.

On the last (I_{10}), it is not inconceivable that the ‘too-big-to-fail’ phenomenon may have encouraged large and complex financial institutions to take on too much risk and adopt Snatcher behaviour. However, few analysts would argue that the expectation that tax payers would end up footing the bill of bank loss was one of the preponderant causes of the financial debacle at the end of 2008.

On the second last, there is no doubt that poor supervision contributed to worsening the opacity of the financial system but it would be hard to argue that this factor provoked the financial catastrophe. Supervision cannot restore transparency if the existing financial regulation is obsolete. For example, the ‘shadow’ banking system was beyond the control of the SEC. On the third last (I_8), there is evidence that loose monetary policy and excessive risk-taking are connected. Taylor (2009, p. 10). This suggests that I_8 (Snatcher culture) was induced by I_2 (Loose monetary policy), and therefore, I_8 cannot be considered as a separable cause of E.

It is generally agreed that re-securitization was a key factor in the generation of ignorance. As complex products multiplied from CDOs to CDOs of CDOs (or CDOs²) it became harder and harder for investors to understand what the quality of the underlying assets had to do with their value. Here (again) there is a causal relation between tentative causes: I_5 engenders I_7 (the relation between causes goes at least one way). It could also be argued that the relationship between re-securitization and

¹⁵ Apparently, the term ‘too-big-to-fail’ was first introduced by Congressman McKinney in 1984. The ‘too-big-to-fail’ problem is due to a lack of credibility and this lack of credibility is just another manifestation of the time-inconsistency problem discussed some thirty years ago by Kydland and Prescott (1977) and Calvo (1978). Nowadays, the term ‘too-big-to-fail’ is applied to a policy in which the government provides guarantees of repayment of large uninsured creditors of the largest financial institutions.

ignorance went both ways, and therefore, there was mutual causality between I_5 and I_7 . In any case, it should be clear that the tentative cause I_7 is an integral part of I_5 .

Consequently, we are left with six candidates: I_1 , I_2 , I_3 , I_4 , I_5 , and I_6 . Quite obviously, the first two items (global saving glut and monetary policy) are related to each other. In essence, there are two possibilities to be taken into account: either the money supply was, at least in part, endogenous or the money supply was incorrectly controlled by the monetary authority.

The first possibility means that global asset scarcity led to large capital flows toward the US and the monetary authority could not control the money supply growth rate (this is not to deny that the Federal Reserve could control the high-powered money stock with considerable accuracy). The second possibility is consistent with central banks' excesses and mistakes induced by abundant liquidity and a decline in US and world interest rates (item I_2). Moreover, this possibility is in line with Taylor's view, namely: the root cause of the financial crisis was loose monetary policy. Taylor (2009). Reality is probably in between I_1 and I_2 . It is for this reason that I_1 and I_2 can be considered as non-separable causes and merged into a separable cause C_0 identified here as 'extremely accommodative monetary policy by the world central banks conducive to low interest rates.' In brief, C_0 means 'monetary excesses.'

The United States was not by any means the only country with low interest rates during the period of time T. Then, why the collapse first manifested itself in the US? Few economists would deny that an acceptable answer is: "Probably because the US went further on financial innovation, thus drawing more marginal-credit-quality buyers into the [housing] market!" Diamond and Rajan (2009, p. 3). The four financial innovations underlying items I_3 , I_4 , I_5 , and I_6 operated concurrently over the period T and reinforced each other engendering a double (housing and credit) bubble.

One typical question about the financial turbulence that engulfed the world starting in July 2007 is how securities backed by sub-prime mortgages could infect the global banking system. Underlying this question is the presumption that the sub-prime mortgage is viewed, at least in part, as a potential cause of the financial collapse at the end of 2008. In fact, it is generally agreed that the origins of the financial crisis 2007-08 can be traced to the sub-prime mortgage innovation and the invention of similar mortgage products such as Alt-A mortgages. See, for example, Dell'Ariccia et al. (2008) and Mayer et al. (2009).

The root problem with securitization and re-securitization was the lack of incentives to monitor the quality of the underlying loans. I_5 (Re-securitization) presupposes I_4 (Securitization), so that for logical reasons I_5 cannot exist without I_4 . In other words, I_4 is an integral part of I_5 , and therefore, I_4 is a non-separable cause of E.

As to I_6 (Credit Default Swaps), the availability of default insurance contracts induced many investors to believe that the uncertainty surrounding the CDOs could be ameliorated. For example, if the AAA-rated tranches of a CDO defaulted, the CDS would cover the corresponding loss. This reasoning crucially depends on the assumption that the probability of the CDS counterparty default was negligible.

The CDSs engendered a mirage. Worldly wisdom captured the relevance of these insurance contracts as follows: buying CDSs was like buying insurance for the Titanic from someone on the Titanic. It is evident that the CDSs delayed the occurrence of the financial collapse and constituted an important magnifying factor of wealth destruction but they cannot be held responsible for the financial collapse at the end of 2008. The biggest problem was the fragility of the securities with bad loans in them, not the CDSs.

The foregoing suggests the following three separable potential causes of the event E:

- C₀: Monetary excesses;
- C₁: Sub-prime mortgage; and
- C₂: Re-securitization.

This triad of causes appears to be at the core of the extraordinarily complex dynamic process conducive to the financial meltdown 2007-08. In rough outline, periods of financial bonanza are driven by monetary excesses and financial innovation. New liquidity-enhancing products (CDOs) based on toxic assets (sub-prime mortgages) engender bubbles and growing uncertainty, especially Knightian uncertainty. As asset prices plummet, fire sales elevate uncertainty enough to impair the efficiency of the financial system. Complexity increases for financial institutions in the sense that they need to understand more and more the financial network to avoid an indirect shock from counterparty risk. The rise in complexity increases the perceived uncertainty of these institutions.¹⁶ When confronted with pervasive uncertainty in the strict sense, economic reasoning is of no value and people suddenly attempt to disengage from distant commitments in favour of liquidity. Ultimately, an intolerable degree of uncertainty suddenly paralyses the lending process.

5. Testing for Causality: Not an Easy Task

The use of language with respect to causality can be very confusing. There is no single definition of causality as illustrated by the discussion in the books by Pearl (2000) and Hoover (2001). According to the Macquarie dictionary, 'cause' is 'that which produces an effect.' This automatically implies that when we state 'C caused E,' we mean that E *followed* from C, that is, C was a *sufficient* condition for E to happen; briefly, if C then E. I call this lay-person approach to causation the *intuitive* interpretation of causality. For example, the statement 'monetary excesses caused the financial crisis 2007-08' means that the presence of abnormally low interest rates was a sufficient condition for the financial crisis to happen.

Causality (the relation between cause C and effect E) in social sciences has always been an awkward topic. It would be quite fair to say that the notion of causality in economics was slippery and ambiguous until John R. Hicks wrote a methodological tour the force *Causality in Economics*. Causality is "not only the study of what happened, but why it happened." Hicks (1979, p. 5).

¹⁶ Caballero and Simsek (2009) have formalized the role of endogenous complexity observed in severe financial crises.

Hicks's definition of causality (henceforth, 'basic definition of causality') is as follows:¹⁷

For causality, we must be maintaining that if C had not existed, E would not have existed; if not-C, then not-E. But not-C and not-E are not events which have happened. (in recent discussions among historians they are described as 'counterfactual').
Hicks (1979, p. 8)

The basic definition refers to an empirical association between economic facts. It is clear that the statement 'C caused E' presupposes that both C and E existed. What may not be as obvious is that the Hicksian definition of causality constitutes a significant departure from the intuitive interpretation of causality. For in strictness, the basic definition transforms the statement 'C caused E' into 'C was a *necessary* condition for E to happen.' Or, to put it differently, C must be present if E is to occur, but by itself is not enough to guarantee that E will occur.

According to Hicks, all causality analysis depends on theory. In particular, a causality test should be based on a theory or model. The test for the basic definition requires the construction of a hypothetical situation (termed *Not-C construction*) in which C did not exist, *ceteris paribus*.¹⁸ It is said that C passes the test if with Not-C, the effect E would not have happened. Hicks (1979, p. 14). For example, the test of the statement 'monetary contraction was the cause of the Great Depression' requires the construction of a theory showing that the absence of monetary contraction implies that the Great Depression would not have happened. In general, the formulation of the Not-C construction is unconstrained in that the selection of the assumptions for the Not-C theory is a matter left in the hands of the economic theoreticians. In broad outline, the Hicksian methodology for causality analysis consists of three steps. First, the analyst has to identify the effect E (an empirical event) and detect one or more potential causes of E by empirical observation. Second, it is necessary to develop theories where the potential causes are not present (the theory is to show what would have happened if some cause had been absent). Finally, for each Not-C construction a causality test must be performed. The causality test consists of checking whether or not the theory in question is compatible with the existence of the observed effect E.

Unfortunately, the Hicksian methodology for causality analysis involves an unavoidable mental gymnastics. If there are only two potential causes, say C_0 and C_1 , the economist should test three possibilities:

Not- C_0 : C_0 was absent while C_1 was present;
Not- C_1 : C_1 was absent while C_0 was present; and
Not- C_{01} : C_0 and C_1 were absent, *ceteris paribus*.

¹⁷ The notation used by Hicks is 'A causes B,' where A and B denote the cause and the effect, respectively.

¹⁸ More precisely, the Not-C construction is not defined as capturing all events other than C occurring over a period of time T, but only all other potential separable causes of E.

When the number of potential causes increases, the analysis becomes increasingly complicated. For example, if there are three candidate causes, say C_0 , C_1 and C_2 , it is necessary to test seven possibilities:

Not- C_0 : C_0 was absent while C_1 and C_2 were present;
 Not- C_1 : C_1 was absent while C_0 and C_2 were present;
 Not- C_2 : C_2 was absent while C_0 and C_1 were present;
 Not- C_{01} : C_0 and C_1 were absent while C_2 was present;
 Not- C_{02} : C_0 and C_2 were absent while C_1 was present;
 Not- C_{12} : C_1 and C_2 were absent while C_0 was present;
 Not- C_{012} : C_0 , C_1 and C_2 were absent, *ceteris paribus*.

As in section 4, the effect E in the statement ‘ C caused E ’ is identified with the sudden stop of the lending process at the end of October 2008. The statements ‘ E occurs’ and ‘ E does not happen’ will be denoted by \oplus and \ominus , respectively. With this notation, statements such as:

‘Not- C_0 and E occurs’ and ‘Not- C_0 and E does not happen’

will be abbreviated by

Not- C_0 and \oplus and Not- C_0 and \ominus ,

respectively. A similar notation will be used for the other possibilities. For example, ‘Not- C_{01} and E occurs’ is denoted by ‘Not- C_{01} and \oplus ,’ and the symbolism ‘Not- C_{012} and \ominus ’ means ‘when C_0 , C_1 and C_2 are absent, E does not happen.’¹⁹

There are several cases that can occur. Table 2 shows only four of them.

TABLE 2 HERE

Cases 1 and 4 are polar cases. Case 1 is obvious: *neither* is a cause. In Case 4, C_0 passes the test, but neither C_1 nor C_2 pass the test, so C_0 is the sole cause. In other words, C_1 and C_2 are irrelevant.²⁰ Case 2 is the case of *overlapping* causes: the effect E occurs if either is present separately or in pairs, but the effect does not occur when C_0 , C_1 and C_2 are simultaneously absent. Finally, Case 3 says that C_0 , C_1 and C_2 pass the causality tests separately, in pairs and together. Each candidate is a separable cause and the crisis will not happen when the three causes are absent. They are *additive* causes.

How many of these cases can be eliminated as inadmissible on the basis of empirical data? None. The tests for causality are theoretical, not empirical. Research appears to suggest the financial crisis 2007-08 fits Case 3 (additive causes). However, the proof that additive causes were present in the financial crisis requires testing seven (non-obvious) possibilities.

¹⁹ The notation is a bit cumbersome but facilitates the discussion. I could not find an efficient way of reducing notational clutter.

²⁰ Few analysts would maintain that the financial crisis 2007-08 can be explained with just one cause.

Adequate or even plausible Not-C constructions do not presently exist. Failure to construct these hypothetical situations implies that the identification of the causes of the financial crisis 2007-08 remains incomplete. It is probably right to conclude from the foregoing discussion that the proof of the existence of causality in the recent financial crisis using the Hicksian methodology is surpassingly stringent.

That Hicks's masterly *Causality in Economics* is a fruitful and suggestive line of approach to causality cannot be doubted. But it is too much to suppose that very many economists have the patient, time, and above all, the creativity necessary to construct the hypothetical situations necessary to test for causality. This may well be one of the reasons why *Causality in Economics* has been virtually ignored in the economics profession. Ordinarily, the economist is not in possession of the required theories and resorts to reliable inference (revolving around intuition, good judgement and good models) to justify informed conjectures about proximate causes.

5. Summary and Concluding Remarks

Although much has already been written about the recent financial crisis, causality issues do not seem well covered by existing models but rather by only informed conjectures. The complexity and multiplicity of forces conducive to the banking crisis 2007-08 make a general theory of this event intractable. Furthermore, the technical details displayed by this crisis were so numerous that they tend to obscure potential separable causes.

In this paper the financial crisis has been identified with the event E, defined as a sudden stop of the lending process at the end of October 2008. The narrative suggests that three facts (namely: C₀: Monetary excesses, C₁: Sub-prime mortgage, and C₂: Re-securitization) are the preponderant causes of E. According to the Hicksian perspective, to show that the statement 'C₀, C₁, and C₂ caused E,' it is necessary to develop seven theories satisfying Case 3 in Table 2.

Scholars in economics are not born to live an easy life. Their existence becomes particularly difficult when they have to find the causes of a massive financial crisis. Many years ago, Paul A. Samuelson made a methodological point that it is still true today, and perhaps will be true forever:

Now in a hard, exact science a practitioner does not have to know much about methodology. Indeed, even if he is a definitely misguided methodologist, the subject itself has a self-cleansing property which renders harmless his aberrations. By contrast, a scholar in economics who is fundamentally confused concerning the relationship of definition, tautology, logical implication, empirical hypothesis, and factual refutation may spend a life-time shadow-boxing with reality. In a sense, therefore, in order to earn his daily bread as a fruitful contributor to knowledge, the practitioner of an intermediately hard science like economics must come to terms with methodological problems. Samuelson (1965, p. ix)

Causality is not only a deep methodological problem but also a most complex philosophical issue. The task of defining and analysing causality from a theoretical angle was undertaken by John R. Hicks in *Causality in Economics*. According to Hicks, causality should be understood as an empirical relation between fact C (cause) and fact E (effect), and theoretical economics should be the ultimate judge in relation to the existence of causality.

It should be emphasized that even if the analyst is able to construct a model in which the logical inference ' $C_0, C_1 \text{ and } C_2 \Rightarrow E$ ' is factually true, this does not prove of itself that C_0, C_1 and C_2 are the causes of E. According to the Hicksian perspective, to show that C_0, C_1 and C_2 are the separable causes of E the economist must develop all the theories involved in Table 2 and confirm that 'E does not happen' holds for all seven possibilities (Case 3, Table 2).

The Hicksian method's great strength is that it requires the elaboration of economic theories to establish causal relations. There are weaknesses, however, inherent to Hicks' approach. The method is arduous requiring the construction of a significant number of theories when there are three or more potential causes to be tested. The art of theoretical economics thinking includes deciding which assumptions to make and this implies that there could be theoretical constructions based on unacceptable assumptions for some economists.

For example, suppose that an economist is able to develop all the theories necessary to test C_0, C_1 and C_2 , that his theories confirm Case 3 in Table 1 with logical compulsion, and that all of his theories assume rational expectations and perfect capital markets in a fundamental way. Would other economists be willing to accept those theories as a proof of causality in the context of the financial crisis 2007-08?

Perhaps the main reason why *Causality in Economics* has been virtually ignored by the economics profession could be found in the following –disturbing– paragraph:

The degree of certainty which we attribute to some of the generalizations (and predictions) of the natural sciences is such that it is hard to distinguish it from logical necessity; we are as certain as that the sun will rise tomorrow as we are that two and two make four. No one can attach that degree of certainty to any economic prediction. Even the lesser degree which attached to predictions in meteorology or medicine is in economics far to seek. Economics is a leading example of uncertain knowledge; it is knowledge, yet it is evidently uncertain. Now if we are able, at least in some relevant aspects, to understand the significance of uncertain knowledge, we can proceed from that to incorporate the case of near-certain knowledge, merely by diminishing the degree of uncertainty. If, however, we take the case of near-certain knowledge as our typical case (especially if we allow ourselves to neglect the –perhaps very small– degree of uncertainty which accompanies it) we are bound to find it much harder to proceed to uncertain knowledge, which then appears as radically different.

Hicks (1979, p. 2)

That is probably *la condition scientifique* of economics: its inability in all too many cases to reach definitive conclusions about causality questions.

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| | |
|-------------------|------------------------|
| I ₁ : | Global saving glut; |
| I ₂ : | Loose monetary policy; |
| I ₃ : | Sub-prime mortgage; |
| I ₄ : | Securitization; |
| I ₅ : | Re-securitization; |
| I ₆ : | Credit Default Swaps; |
| I ₇ : | Ignorance |
| I ₈ : | Snatcher culture; and |
| I ₉ : | Poor supervision |
| I ₁₀ : | Too-big-to-fail |

Table 1 (Tentative causes)

| | Case 1 | Case 2 | Case 3 | Case 4 |
|----------------|---------------|---------------|---------------|---------------|
| Not- C_0 | \oplus | \oplus | \ominus | \ominus |
| Not- C_1 | \oplus | \oplus | \ominus | \oplus |
| Not- C_2 | \oplus | \oplus | \ominus | \oplus |
| Not- C_{01} | \oplus | \oplus | \ominus | \ominus |
| Not- C_{02} | \oplus | \oplus | \ominus | \ominus |
| Not- C_{12} | \oplus | \oplus | \ominus | \oplus |
| Not- C_{012} | \oplus | \ominus | \ominus | \ominus |

Table 2 (Three potential causes and four illustrative cases)